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Activity Trackers for Raising Guide Dogs: Challenges and Opportunities

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Guide puppy raisers play a crucial role in the process of training assistance dogs supporting mobility of the visually impaired. Recent technological developments bring about a plethora of IT-based solutions, such as canine activity trackers and mobile apps, that could

provide novel benefits in supporting the puppy raisers in their important contribution to society. We present an exploratory empirical study of the perceptions and attitudes of puppy raisers and their guide dog center towards such technological solutions focusing in particular on their perceptions towards privacy.

Guide dogs have been shown to provide assistance with mobility and independence for the visually impaired, while offering the additional benefit of companionship^{1,2} and are increasingly used worldwide. Preparing a guide dog is a complex process which requires considerable resources and intensive training^{3,4}. A key role in the training process is played by volunteer puppy raisers, who serve as custodians for the animals for about 12 months. They are responsible for basic obedience training, exposure to various stimuli and socialization of the puppy during the first critical year of its life. During this period, they are typically supervised and guided by trainers of the Guide Dog Centers. They usually also form local puppy raising social groups, wherein they share ideas and information, work on training techniques, and participate in socialization outings. After 12-15 months the puppies return to the Centers for formal guide dog training of several months, after which they are placed with a vision-impaired person, to commence their working life.

Despite their crucial contribution to the process of guide dog training, puppy raisers have mainly been included in research studies only as sources of information^{5,6,4}. Only one study addressed

the experiences of puppy raisers⁷ – calling for further research to ensure that volunteers are being supported in their important roles in relation to the training of service animals.

Recent technological developments, such as sensor technologies and Internet of Things (IoT), open up new possibilities for technological enhancement of the human-canine relationship in various contexts. There is a plethora of commercially available canine activity trackers, such as FitBark, Whistle or PetPace. Such devices measure activity and sleep patterns, calorie intake, heart rate and body temperature, etc. Alcáidinho et al. proposed assessing the suitability of potential working dogs using canine activity trackers in a pilot study⁸ and showed that the use of such trackers can increase permanent adoption rate of shelter dogs by impacting the bonding between dog and owner⁹. The findings also suggest that monitoring the dog can affect humans' behavior, analogously to the way framing personal health information affects behavior and health change¹⁰.

Alcáidinho et al. noted design considerations for developing such technology by discussing safety, space, weight and comfort¹¹. They also specifically call for more exploration of privacy effects of wearable technology for companion animals¹². A first step is assessing potential threats, and whether users are aware of it. Several cases in which privacy of users may be affected through animal-worn technology have been discussed in¹³, but little empirical work has been done on users' privacy perceptions.

Several studies address technological solutions specifically tailored for working and assistance dogs, facilitating various types of interactions of dogs with their handlers^{14, 15}. For puppy raisers, there are several aspects in which these technological aids for monitoring the behavior and well-being of dogs have the potential to support their duties. Firstly, they can improve the quality of care-giving, both directly, by making the puppy raisers more aware of the needs of their puppies (e.g., the expected amount of walking and sleeping), and indirectly, by affecting the dog-human bond⁹. Secondly, and more importantly, these canine activity trackers can help address an important gap, unique for the puppy raiser community, namely the need for efficient communication between the puppy raisers and the Centers. Indeed, a study which explored the experiences of puppy raisers⁷, found they felt they did not have sufficient information from the Center about expected puppy behavior, or immediate feedback on whether they were doing the right things. Additionally, expressed was a need for praise and reassurance from the Center. Activity trackers combined with mobile platforms can indeed provide new technology-enhanced means for improving the quality of communication between the puppy raisers and the Center, making the guidance and feedback more personalized, and delivering it just-in-time for actionable response.

Despite the potential benefits, the use of such devices incurs also some privacy risks, namely sharing information that may (in)directly reveal personal or otherwise sensitive details. In addition to the typical concern of revealing one's location, it may also indirectly reveal other details related to care-giving, such as times of feeding, or the amount of time the dog is left alone. Therefore, privacy concerns can form a significant barrier to the adoption of technologies in the context of puppy raisers. This calls for better understanding the way in which the potential value of the use of technology is perceived by the puppy raisers user group, and whether this value may prevail over the risks of sharing potentially sensitive information, as well as understanding the Centers' point of view in this context.

In this exploratory study we investigated the value of technological solutions such as canine activity trackers as perceived by puppy raisers and Centers, as well as their concerns related to the use of technology and sharing of data. To this end we addressed the following research questions:

1. What is the perceived value of canine activity trackers for puppy raisers, if any?
2. What are their concerns about the usage of canine activity trackers, if any?
3. What are their concerns about their puppy's data sharing, and in what circumstances and contexts it would be acceptable?

THE EMPIRICAL STUDY

Participants. Twenty-two puppy raisers were recruited in a designated WhatsApp group which serves as support social network for Israeli puppy raisers from several Centers. Additionally, in a second phase of the study, three handlers from Guide Dog Centers were approached to further comment on the findings. No personal details were recorded. All participated voluntarily and received no compensation for their participation.

Procedure. The study was implemented as a questionnaire incorporating open-ended questions and Likert scale questions to assess attitudes towards data sharing. We piloted a first version of the questionnaire with an active puppy raiser who has already raised a successful guide dog in order to tailor the questions and background information to their context.

To ensure that all participants understood the concept of canine activity trackers even if they had not heard of them before, an optional background section was displayed, briefly explaining the concept and benefits of such devices. Following this (optional) introduction, we asked participants to rate on a Likert scale of 1 (strongly disagree) to 5 (strongly agree) statements that “I would...”

- ... use a canine activity tracker
- ... share data with the guide dog center
- ... share data with my peers (other puppy raisers in my social group)

This was followed by open questions asking participants how being a puppy raiser had affected their lifestyle, and to reflect on the factors that would affect their willingness to share data with different entities.

Subsequently, we presented the following data privacy statements to measure participant’s perceptions of data captured by canine activity trackers, asking them to rate their agreement on the used Likert scale. Each sentence began as “The data a canine activity tracker captures of my puppy...”

- ... is personal data that can be used to identify me.
- ... should not be shared with others without my informed consent.
- ... should be shared with the guide dog center, regardless of my consent.
- ... should be shared with other members of my peer group, regardless of my consent.

Finally, we presented an open question asking participants to reflect on the sharing of data captured by such a device in their context of puppy raising.

At the second stage of the study we held semi-structured interviews with three handlers from a Guide Dog Center. These interviews focused on eliciting and contrasting their perception towards the value of canine activity trackers, and the pitfalls they perceive in regard to data sharing.

Data analysis. The Likert scale answers are shown on Fig. 1. We used open coding¹⁶ to analyze the results of the open questions. All data elicited in the open questions was coded individually by both authors over two iterations. Resulting codes were compared and integrated as an initial classification framework. This framework was then applied to the data by both authors, with a Cohen’s κ of 0.912 (indicating ‘very good’ inter-rater agreement). The following coding framework was used:

- *Perceived value:* [**value**], what potential use/benefits puppy raisers see in the devices (10 counts)
- *Concern about device use:* [**cond**] (19 counts), what conditional requirements puppy raisers have for their use; [**wconcern**], and what device-specific concerns puppy raisers have for their use (3 counts)
- *Concerns about data:* [**dconcern**] (6 counts), what general data concerns puppy raisers have; [**pconcern**], or what privacy specific data concerns puppy raisers have (5 counts)

Threats to validity. *Construct validity.* We ensured participants understood the functionality of canine activity trackers by presenting a basic explanation before the questionnaire. Moreover, for concepts that may be ambiguous we used simple explanations (e.g., explaining ‘personal data’ as ‘information that can be used to identify you’) as a balance between avoiding ambiguity and priming. *External validity.* Our data sample consists of puppy raisers working for two different Guide Dog Centers in Israel. While their protocols are similar to several US organizations, this sample could limit the generalizability of our findings, for example by being biased towards a particular culture. Moreover, the experience level (i.e., how many puppies participants have raised) may affect their answers, although this effect would be minimal due to fairly similar level of experience across the sample.

FINDINGS

Of the twenty-two participants, the majority (19) were aged 25–34. One participant was aged 45–54, and two participants were aged 18–24. Most were first-time puppy raisers (14), some already raised puppies before (4), and some raised puppies before but were no longer actively doing so (4). The majority of them had heard of canine activity trackers before.

Overall, in contrast to Chur-Hansen et al. ⁷, our participants were positive about the extent and usefulness of feedback they receive, both from the Center and their peers (averaging around 25% negative attitude towards receiving useful and sufficient feedback from both the guide dog centre and their peers), as well as being very confident that they give good quality care to the puppy under their responsibility (averaging about 80%). Still they expressed the need for more personalized guidance and feedback, that could be provided using canine trackers, as will be highlighted below.

Figure 1 shows participants’ attitudes towards the use of canine activity trackers and sharing of data with both the Center and their peers. We discuss these results below.

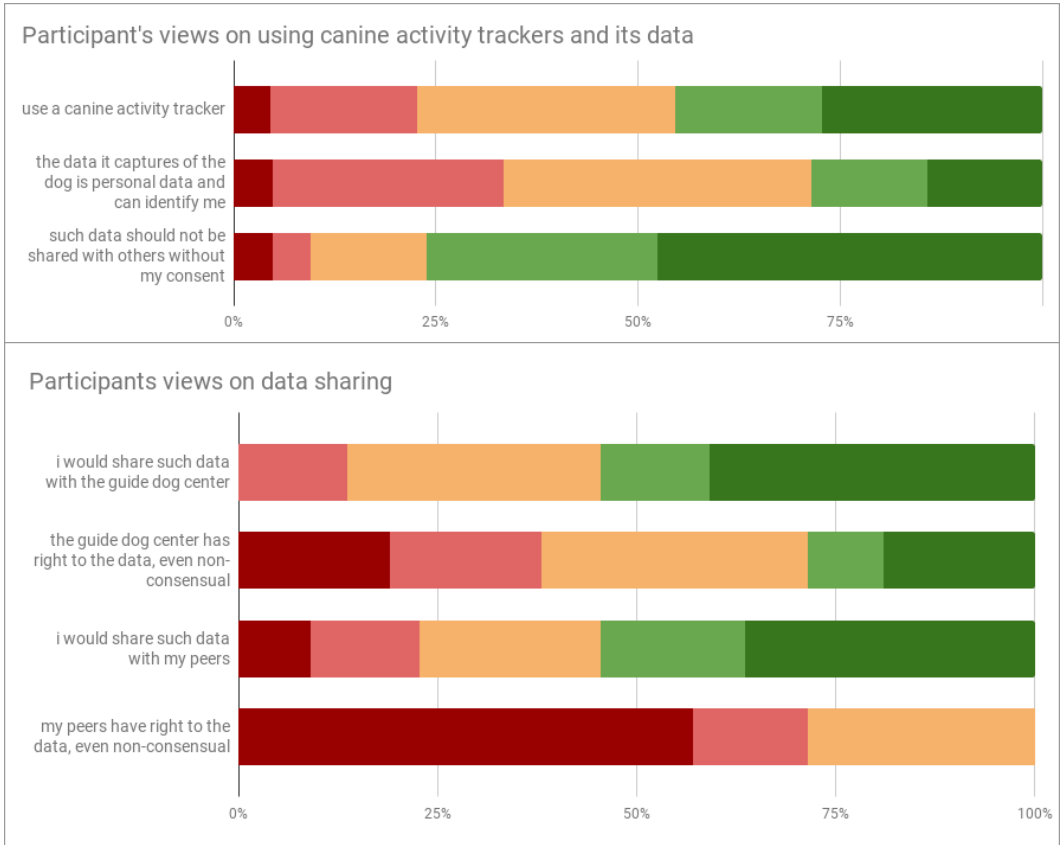


Fig. 1. Attitude of puppy raisers towards canine activity tracker use and data sharing (n=22)

Perceived benefits of canine activity trackers by puppy raisers

The majority of participants felt positive about the value of the devices. Figure 1 shows that more than half of the participants would be willing to use a canine activity tracker for their guide dog puppy. The main concrete benefits ([**value**]) extracted from by the participant's answers were:

A technological platform for puppy raisers to receive timely guidance from the Center. Several participants indicated they would welcome any “additional guidance, beyond the meetings with coaches.” These centered around the potential of such wearables providing additional guidance, where it would not be efficient to turn to official support: “sometimes you need a reminder about the small things and do not want to always turn to the trainers.”

A technological platform for Center to monitor puppies. Participants noted that indeed the Center could have value from puppy raisers using canine activity trackers: “[the wearables and their data] should be available to the guide dog center in order to guarantee the wellbeing of the puppies, save time when puppy should be attended by trainer or transferred & help decrease the cases of incompatible puppies due to lack in care & training.” Also: “Maybe if the Center suspects the family not going enough with the dog then it can be used for surveillance.”

Increased awareness and understanding of the dog's well-being and behavior. Participants noted the potential benefit of canine activity trackers in providing more detailed information, e.g., “it's nice to know information about the dog and to discover things about it and sometimes it can be important to understand things that happen to it.” Moreover, participants noted that “it can only improve our treatment of puppy. This allows us to be monitored and able to build a routine for a specific animal to be more easily and quickly adapted.” A related benefit is the ability for raisers to compare their puppies to peers: “It would be helpful to know where my puppy stands compared to others”.

Concerns about the usage of canine activity trackers

Many participants referred to data ownership and privacy issues, which are discussed in further details in the next subsection. A minority ($\pm 20\%$) of participants expressed strong views against the use of dog wearables, expressing mainly concerns that it may be uncomfortable or unsafe for the dog ([**wconcern**]):

I think it's not right to connect a device to a dog to keep track of his activities ... and it might be uncomfortable for it.

It seems irritating and troublesome to me.

Data sharing

The questions on data sharing addressed two different scenarios: sharing with the Center and sharing with peer puppy raisers. As shown on Fig. 1, participants' views on these two scenarios significantly differed. We discuss in more details below each of the scenarios.

Sharing with Guide Dog Center. An interesting finding comes from the most prevalent code ([**cond**], with 19 counts) showing that participants accept any *conditions* set by the Center: the Center has the right to any data related to puppies, and is entitled to make decisions whether to use canine trackers, and to use their data, even without receiving consent from the puppy raisers. This is reflected in the following statements:

The puppy does not belong to me, so any information related to it should reach the trainers and the center. That's what I volunteered for.

If the organization needs to use the data, so be it – they dictate almost everything regarding the dogs' lifestyle anyway.

The use of such a device should be a decision of the center. If they decide to use the device, I would obey. I do not have my own opinion on this.

The center should not need to ask for permission to monitor their dogs.

Notably, there was only one participant who, unlike others, expressed the view that “the dog is still mine and there is no reason anyone else will have information on it.”

Concerns about the data ([**dconcern**]) and privacy ([**pconcern**]) were raised by several participants. For example, one participant pointed out: “No organization can decide to use my private information without my consent. It does not matter what it is about.” Another participant, while reflecting on data sharing, noted: “I think the only problem is self-location, because I am where the puppy is.” Specific conditions under which participants would be willing to share data about their puppy with the Center include the following:

Health-related:

I would not want the organization to monitor everything I do. It is hard to do all the things required by them. I would rather share the information with the organization concerning the puppy's health when needed.

When the puppy is not well the data should be shared with the Center even without my consent, but as long as the puppy is healthy there is no reason to share it.

With consent:

It is important to pass on the information to make it actionable, but it should be with one's consent. I do not always want other people to receive this information because it can reflect my level of commitment.

With choice:

I would rather not share with the trainers information about eating, because we disagree on this issue (hours/quantities).

Sharing with peer puppy raisers Fig. 1 clearly shows the differences in perceptions of right to access data between peers and the center: while the majority of participants would be willing to share their dog's data with their peers, much less thought their peers have the right to access such data without their consent. Some participants brought up this distinction explicitly in terms of privacy concerns ([**pconcern**]):

I think the center has the right to know everything (to a certain extent), but on the other hand I have the right to choose what to disclose to other peer raisers and it is my right to keep the information very very restricted.

The puppy belongs not to me but to the guide dog center. Therefore, if they wish, they have the right to receive all information collected by the app without the need for explicit consent from me. On the other hand, I would share it with the rest of the puppy raisers only if they asked, or only if there was a large anonymous form containing everyone's data.

Several participants noted they also would not want to be flooded with data from their peers:

It would be helpful for me to know where my puppy stands compared to others, but I would not want to be flooded all day with messages.

In my opinion it complicates things. I would not want to see any other dog's data.

The Center's Point of View

We interviewed three handlers from Guide Dog Centers, whose responsibilities include guiding and supervising puppy raisers in their daily duties. We presented to them the findings described above and asked about potential value they see for the use of canine activity trackers in puppy raising, as well as any concerns they would have. All handlers noted the usefulness of information these devices could provide, from establishing average activity levels of the puppies, to more specific identification of situations where puppies exhibited significant inactivity or showed unusual changes in routine which indicate early onset of disease or behavioral problems. Such information would be valuable in giving immediate accurate feedback to the raiser to focus on dealing with concrete challenges. Moreover, one handler further added: “[the use of canine activity trackers] embodies many possibilities of which I am certain we have not yet even thought.” Yet the handlers also expressed strong reservations due to potential privacy issues related to using canine activity trackers and were concerned it would be eventually too troublesome for the Center to deal with them. One handler noted: “I am sure privacy will be an issue for some of the raisers and might even scare them away.” Another used a strong metaphor stressing the privacy issue: “This is very problematic in my opinion. It is like George Orwell’s 1984.”

DISCUSSION

Canine activity trackers perceived useful by puppy raisers

Among the challenges of the puppy raising experience, Chur-Hansen et al.⁷ mention the lack of timely feedback and instructions from the Centers. Although the participants of our study found their communication with the center overall satisfactory, some of them mentioned improving communication and making it timelier and personalized as a significant potential benefit of canine-worn trackers combined with suitable mobile applications. Improved communication working both ways could lead in its turn to improved compliance to the centers’ guidelines, which is valuable because even responsible owners often fail to comply with recommended care-giving practices¹⁷. In the context of guide puppies, compliance with guidelines of the center’s trainers is crucial for the success of the guide dog training process. Although not mentioned by our participants, canine activity trackers can also have health benefits both for the puppies by affecting behavior of the human care-givers⁹, analogously to human activity trackers¹⁸⁻²⁰.

Guide dog centers have got carte blanche...

One of the most actionable observations emerging from our results is the belief by the majority of the participants that the use of canine trackers or other technological solutions is solely a decision of the Centers and would be accepted unconditionally. This can serve as a starting point for exploring concrete ways in which Centers could employ technological solutions to support and monitor puppy raisers.

Some concrete ideas for IT-solutions envisioned by our study participants were (a) the center providing online and/or more on-demand guidance and feedback to puppy raisers so as to relieve the need to wait for scheduled meetings with trainers, (b) compiling all puppy raisers’ data so that puppy raisers having the ability to compare themselves and their puppy to peers, (c) providing access to videos showing how to react to dog’s behavior in particular contexts such as eating from the floor, and (d) having quantified data of one’s puppy for increasing awareness and understanding of its behavior. An interesting parallel can be drawn by looking at IT intervention strategies that were found efficient in healthcare settings. Such strategies, categorized in Klasnja and Pratt²¹ include (i) involving the teams (remote coaching, remote symptom monitoring,

automated feedback), (ii) leveraging social influence from individuals sharing the same goals (peer puppy raisers in our context), (iii) increasing accessibility of information, and (iv) self-monitoring. These strategies have a clear mapping to the above-mentioned ideas (a) - (d) emerging in the context of puppy raisers. Beside (c), these ideas could indeed be implemented based on canine activity trackers.

... but privacy needs to be dealt with!

While Guide Dog Centers seem to have the freedom in implementing IT-based solutions for communicating with puppy raisers, strong emphasis should be placed on doing so in a way that respects their privacy. As Fig. 1 shows, most participants were unsure (or disagreed) that canine activity data could reveal information (or identity) about them. This may explain their overall willingness to share data with the Center, and in particular note that they would be willing absolutely to share such data even without explicit consent if the Center asked for this. Given that privacy is typically a major concern for wearable users²², it is particularly striking to see the acceptance this class of potential users has for allowing non-consensual data collection. Moreover, as is known from literature, sensor data captured by devices like fitness trackers has the strong potential to allow for personal (re-)identification²³. This means that data, which on a first glance does not seem related to a person at all (as participants now perceive data captured by canine activity trackers), might still allow for identification and should thus be treated carefully as personal data.

Initiatives to use canine trackers for guide puppy raising, have to consider the pragmatics of data protection. The Israeli Privacy Protection Regulations, 5777-2017, similarly to the General Data Protection Regulation (GDPR) (EU) 2016/679, sets out extensive requirements for handling personal data. Since data captured by canine trackers allows for (indirect) identification of the puppy raiser, the raisers themselves are 'data subjects' protected by these regulations, and consequently hold irrevocable rights, to which the guide dog center needs to be attentive. For instance, due to the "right to be forgotten", puppy raisers may request for such activity data indirectly identifying them to be deleted, compromising the quality of the activity-related database collected by the Center. The problem is made worse by the fact that commercial off-the-shelf solutions such as FitBark or Whistle offer little control over exactly what data is captured, how it is stored, let alone where. In an ongoing project analyzing data captured by pet wearables we found relevant privacy policies typically use vague, compound terminology to describe captured data, e.g., "pet activity profile". This does not allow for a straightforward assessment of whether, and what personal data can be inferred from the data. Moreover, many devices store data on company servers or cloud service providers and allow for data sharing with third party service providers. In short, like many other organizations, Guide Dog Centers are not well equipped to handle the complexities that the use of canine activity trackers brings in terms of data privacy.

CONCLUSION

The technological needs of the user group of puppy raisers have so far been largely overlooked. Yet IT-based solutions, such as mobile applications and canine activity trackers offer new benefits to all stakeholders in the guide puppy raising process, including Guide Dog Centers and puppy raisers. The presented study explored the perceptions and attitudes of puppy raisers, identifying the perceived benefits of technological solutions and highlighting their concerns mainly related to data sharing. Moreover, we explored the presented issues from the perspective of Guide Dog Centers, showing an apprehension towards using these devices for fear of violating puppy raisers' privacy. The complicated reality of implementing canine activity trackers in the puppy guide raising process, while being respectful of individual raisers' privacy and adhering to relevant legislation indeed requires more research efforts in order to support these centers in their important contribution to society.

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